

Mini-Investigation

How Can One Tell Whether Two Parameters Are Interrelated?

Overview

Students create climatographs for their site and the two sites examined in the *What Are Some Factors That Affect Seasonal Patterns? Learning Activity*. They analyze each climatograph to determine if temperature and precipitation patterns are interrelated. Students then examine how the three sites are alike and different based on their temperature and precipitation patterns. Finally, students generate ideas about what might cause the patterns to be different. They repeat this process with other parameters.

Procedure

Step 1: Have student groups obtain the monthly summaries of the *Atmospheric Temperature*, *Precipitation Rain*, and, if appropriate, *Precipitation Solid* data from your site and the two sites examined in *What Are Some Factors That Affect Seasonal Patterns? Learning Activity*.

Note: You can either provide students print outs or have them use the Student Data Archive to obtain these data. If your site has limited amounts of data, use the menus in the Student Data Archive home page to find a nearby GLOBE site whose

data you can use. To generate a table of monthly summaries, see *Obtaining Average Monthly Data* in the *Appendix*.

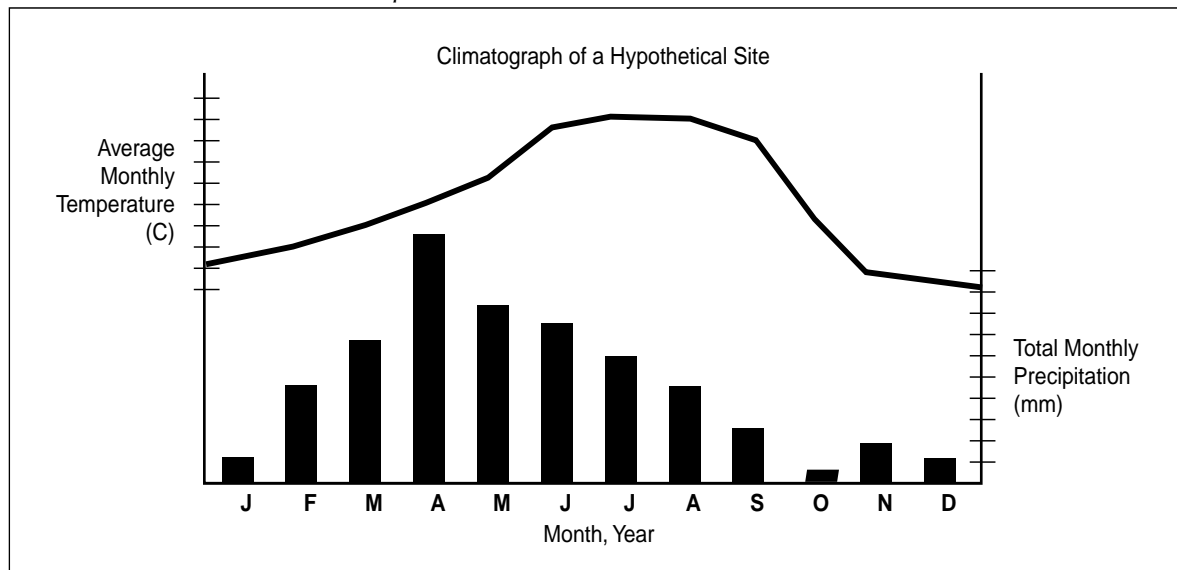
Step 2: If any of these sites have *Precipitation Solid* data (i.e., snow and ice), have students calculate the total amount of precipitation for each month by adding *Water Equivalent* column (under *Precipitation Solid*) to the *Precipitation Rain* column.

Step 3: For each site, have students plot the *Average Current Temperature* and the total precipitation (i.e., *Precipitation Rain* plus *Precipitation Solid — Water Equivalent*) month-by-month onto a single graph for a year. See Figure SE-A-1.

Note: All three average monthly temperatures – the current, maximum and minimum – will show annual trends equally well, and you can have students plot any one of them. Make sure each student puts a copy (hand-written or a print out) of each graph in his or her GLOBE Science Notebook.

Step 4: Have students analyze each graph. See how well they can analyze them on their

Figure SE-A-1: A Climatograph displays a site's temperature and precipitation levels. Precipitation is shown with a bar graph because it is a cumulative, not continuous, phenomena.





own. If they need prompting, ask questions such as:

- When does the wettest month occur? The driest? The hottest? The coldest?
- How is the precipitation distributed over the year?
- What are the maximum temperature and precipitation values? The minimum?
- What temperature range is associated with the maximum precipitation levels? The minimum?

Note: Have students do their analysis of the three sites in small groups and then develop a class-wide understanding of each site by having them share their analyses in a class discussion. The analysis can also be assigned as homework.

Step 5: For each site, have students write a summary statement in their GLOBE Science Notebooks about whether the precipitation and temperature patterns at each site are interrelated. Also, have them write three to five questions relating to temperature and precipitation patterns.

Note: Patterns are said to be interrelated when a change in one causes a change in the other. However, the patterns need not be identical. For example, when temperatures in many regions are at their highest, the precipitation levels are at their lowest. Even though these patterns are opposite, they are still interrelated because when the hot season ends and temperature levels fall, the precipitation levels usually increase. This cause-and-effect relationship is what characterizes interrelated phenomena.

Step 6: Have students compare the three climatographs by creating lists of how the three sites are alike and different. See how well they can analyze them on their own. If they need prompting, ask questions such as:

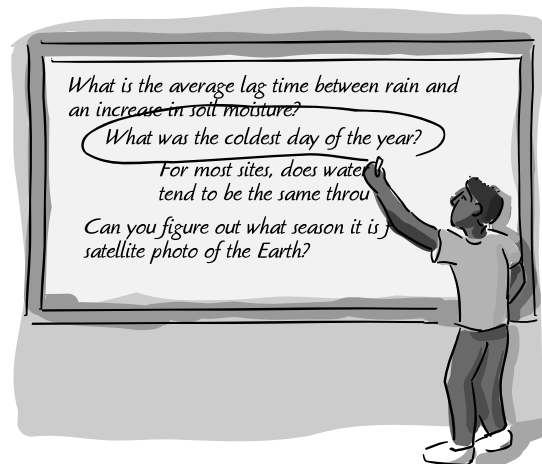
- In general, which site is the hottest? The coldest? The wettest? The driest?

- In what way are the patterns on the three climatographs most alike? Most different?
- Describe each season based on the temperature and precipitation patterns at these sites.
- Describe the plant and animal life one might find at the distant site.
- Describe how the temperature and precipitation patterns might affect how people live at the distant site.
- What kinds of climates are represented by each of the climatographs? (Ask only if students are sufficiently prepared to answer this question.)

Note: Have students do their initial analysis in small groups and then develop a class-wide understanding of each site by having them share their analyses in a class discussion. The analysis can also be assigned as homework.

Step 7: Have students write a hypothesis in their GLOBE Science Notebooks about what they think causes annual temperature and precipitation patterns at the three sites to be different. Also, have them write three to five questions relating to temperature and precipitation patterns at different sites around the world.

Note: *What Are Some Factors That Affect Seasonal Patterns? Learning Activity* explores how latitude, elevation and geography influence annual patterns. Differences in any of these factors will cause differences in the annual temperature pattern. Since precipitation is



based on a relationship between temperature and the amount of water vapor in the air, anything that influences either of these factors will influence precipitation levels. See *Two Key Factors That Influence Precipitation Levels* in the background section for a more complete discussion.

Step 8: Have students share some of their hypotheses and questions relating to temperature and precipitation patterns and create a master list. If questions such as the following do not emerge, add them to the list.

- Are temperature and precipitation levels interrelated?
- Do temperature and precipitation levels follow similar patterns around the world?
- Why are precipitation patterns at the distant site different from those at our site?
- Are precipitation levels influenced by latitude, elevation and geography the way temperature levels are?

Note: Use a wall map of the world or the maps found under GLOBE Visualization to focus attention on differences in latitude and elevation, and in proximity to oceans and other significant geographic features.

Step 9: Following a procedure similar to the one outlined in Steps 3-8, have students choose other GLOBE parameters and investigate how their annual patterns are related to the temperature and precipitation levels.

Step 10: In their GLOBE Science Notebooks, have students write a statement about how the parameters measured in GLOBE are interrelated.

Extension

- Consider having students investigate some of the hypotheses developed in Steps 8 and 9.
- By creating climatographs for sites around the world, challenge students to identify as many different kinds of climates as possible. See the ten climatographs in Figure SE-A-2.

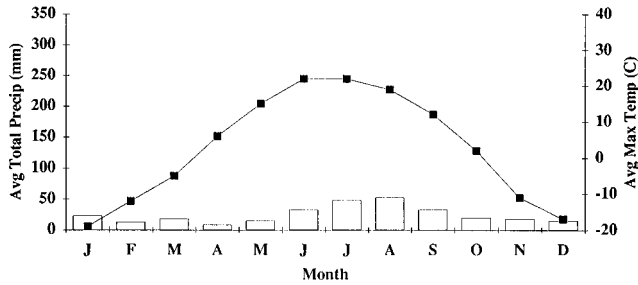
Assessment

By the end of this activity, students should be able to use graphs and data to:

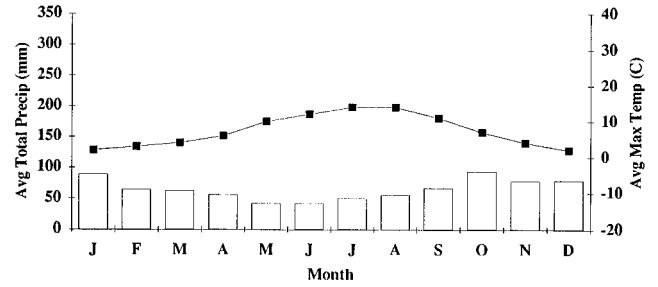
- create a climatograph;
- analyze a climatograph to understand a site's temperature and precipitation patterns;
- make reasonable inferences about a site's plant and animal life based on its climatograph;
- support the claim that seasonal patterns are influenced by a combination of latitude, elevation and geography;
- show that the annual patterns of the parameters measured in GLOBE are interrelated.

Figure SE-A-2: Sample Climatographs: Patterns Associated with Different Climates

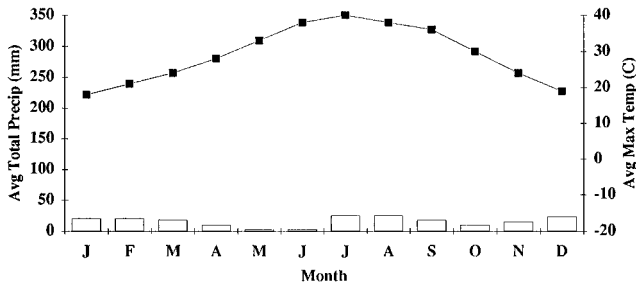
Fairbanks, Alaska, USA (65N 148W 134 m) Polar Continental Dry



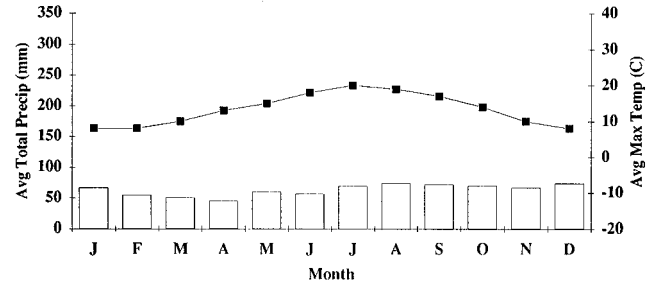
Reykjavik, Iceland (64N 22W 18 m) Polar Marine Tundra



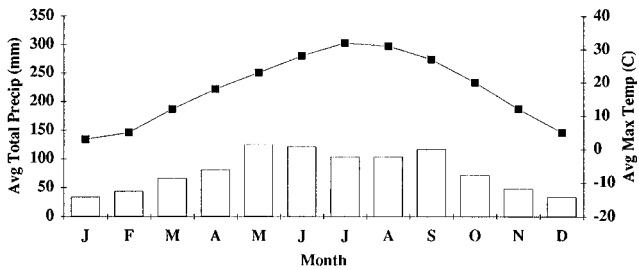
Phoenix, Arizona USA (33N 112W 330 m) Temperate Continental Desert



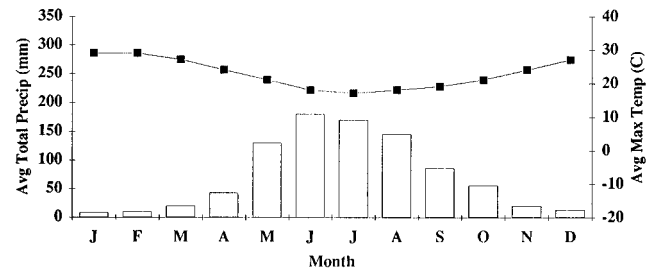
Dublin, Ireland (53N 6W 47 m) Temperate Marine



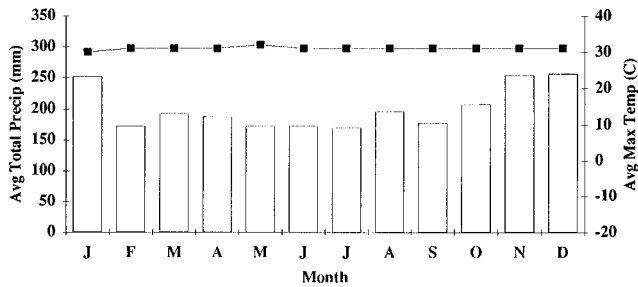
Kansas City, Missouri USA (39N 95 W 226 m) Subtropical Continental Humid



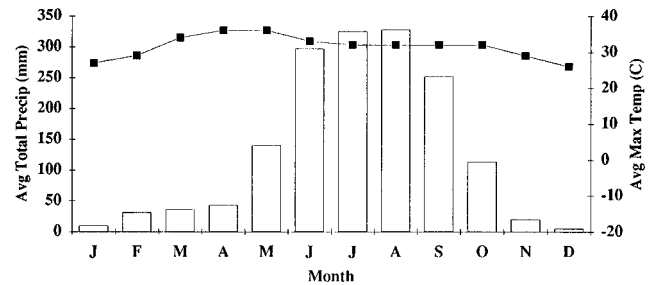
Perth Australia (35S 139E 43 m) Subtropical Dry Summer (Mediterranean)



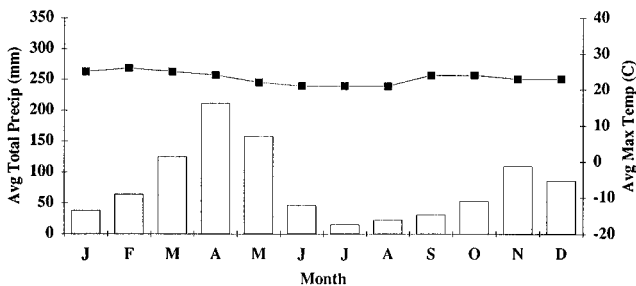
Singapore (1N 104E 10 m) Tropical Wet



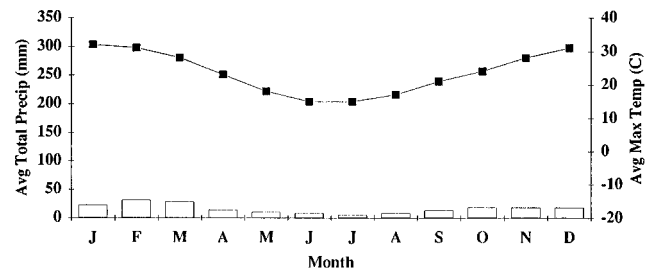
Calcutta, India (23N 88E 6 m) Tropical Wet-Dry (Monsoon)



Nairobi, Kenya (1S 36E 1820 m) Tropical Semiarid Upland



Mendoza, Argentina (33S 69S 801 m) Subtropical Continental Dry (Rainsadow)



□ Average Total Precipitation

---■--- Average Maximum Temperature